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ABSTRACT

Statistics indicate computer use is increasing in homes, schools, libraries, recreation centers, camps, and parks. However, the relative effects of computer use on children with ready access to computer-based technologies and on children who have only limited experience with such technologies is at question. The source of impact is the computer software that touches children's lives. Various authors have argued that children can reach the stage of formal operations within certain content areas while remaining in the stage of concrete operations in others. The use of "general-purpose" computers can give children power and control resulting from their mastery of command structures to direct the operation of the computer. The roles of patterning, sequencing, and conditional reasoning in the creation of programs; in the use of general purpose software; and in the acquisition of programming skills are important. Contrary to general-purpose computer software, "canned programs" direct children's attention toward specific goals, and the child's interaction with the program requires the use of some fixed set of responses to achieve those goals. Computers are currently being used to simulate activities and provide skill drills. Incidental effects of these programs will include higher levels of expectation of graphic, textual, or sound reward for good performance and, possibly, heightened awareness of computer capability. (BJD)

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The Impact of Computer Technology on Children

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Computers will soon be everywhere that chilren are: at home, at school, at play. Statistics almost a year old indicated that one in every one hundred homes housed a home computer; this percentage is surely growing, especially as Timex now markets a computer for $99 (which sells in a local discount store for $79) and other low cost computers are available. In addition to the home, the use of computers in elementary schools is growing rapidly, and many libraries have acquired them. Recreation centers are often acquiring microcomputers, and we see computer camps and computer parks as a growing phenomenon. And I haven't mentioned the seemingly omnipresent computer games, and the many computers dedicated to specific applications that children encounter daily.

That computers and related technologies do have, and will have, an impact on children is not an arguable point. The question is what will be the nature of this impact. In my remarks this morning I would like to make a few observations concerning characteristics of computer applications and capabilities which might shape this impact. Before turning to these it is important to note that one potential effect of the availability of home computers coupled with a multitude of software applications could be the further separation of the classes in our society. In a sense we must address two questions: 1) what will be the impact on those children who have ready access to computer based technologies for their own uses and 2) what will be the impact of a computer saturated society on those children who have only limited experience with the technologies?

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Focus on Software

With the possible exception of personalized robots, the computer hardware, in and of itself, would have very little impact on children. The source of the impact is the software; it is the programs and command systems which direct the operation of the machine. General purpose software systems support the operation of the machine. Other software systems support the operation of games, word processing, graphics, computer networking, and the numerous other applications of computers which will touch children's lives.

The most general software systems - languages and authoring systems - afford the user the opportunity to run the computer. The LOGO language, touted by Seymour Papert and others (Papert 1980) is a command system which is quite accessible to children; it allows children to create and move graphic figures by commanding a "turtle" (cursor) or a series of "sprites" to perform certain operations (go forward, turn right, pen down). Children using LOGO can explore various possible moves, use moves to create figures, save their creations and use them in the construction of more complex creations. The LOGO system is recursive, that is, it specifically allows for the redoing of operations ad infinitum.

Papert argues that the use of LOGO allows children to "mathematize," to behave like mathematicians, rather than simply to learn the mathematics that adults think good for them. It should be noted that Papert worked with Piaget and claims a relationsnip between his work with LOGO and the developmental theories of Piaget. In particular, Papert argues that work with LOGO provides children with experiences which enable them to enter the stage of formal operations at earlier ages than Piaget's twelve year olds. It is important to note, however, that various authors have argued that children can become

formally operational within certain content areas while remaining in the stage of concrete operations with respect to other areas. Piaget himself concurred with this point of view in a paper written in 1972. Thus, although it seems that children can learn to perform LOGO operations which appear to be formal in nature, there is no evidence to date concerning the generalizability of these operations.

The child using the LOGO system does cause something to happen, an interesting (and possibly very complex) picture to appear on the screen. Fred Goodman (1980) of the University of Michigan argues that the ability to cause something to happen, that is, to send durable messages, characterizes the major effect of computers on children. Discussing computers from the point of view of language arts instruction, Goodman notes that in the past children's written statements were exclusively what he calls SD messages: they travelled short distances and had only short duration. With computers, children can send LD messages, that is, long distance, long duration messages which cause things to happen. Use of the computer can give children power and control.

The observations of Papert and Goodman would seem to apply to some extent to all systems in which children use fairly general command structures to direct the operation of the computer. In the programming environment children can cause things to happen on their own computer monitors or elsewhere. Thus, used as a general purpose tool, the computer can give children new opportunities and new control over a part of their environment.

The roles of patterning, sequencing, and conditional reasoning in the creation of programs, in the use of general purpose software, and in the

acquisition of programming skill are important. Investigations are needed to determine the extent to which children acquire these abilities in the computer environment at earlier ages than they have in the past, and the extent to which these abilities generalize, both among computer environments, and from computer environments to other situations.

Working Within Programs

While general purpose computer software gives children opportunities to create and control, "canned programs" direct children's attention toward specific goals. Whether these goals be winning a game, learning a concept, or solving a problem, the child's interaction with the program requires the use of some fixed set of responses to achieve the goal. Extensive use of diverse computer programs is likely to produce both intended and incidental effects on children. At the present, we don't know what all of these effects are likely to be; however, we can anticipate some of them.

Computers are currently being used to simulate (sometimes well, but often poorly) many activities in which people habitually participate in the so-called "real world." To the extent which these programs are successful they abstract some part of the physical or intellectual experience of the child and allow the child to manipulate and control certain aspects of those abstracted entities. Insofar as the child relates the computer-based representations to the real world, he or she can discover causal relationships among the abstracted phenomena. Even if the abstraction is not clear to the child, he or she can still experience the cause-effect relationship in the simplified environment of the computer.

The current generation of educational programs are largely designed to provide drill on specific skills. If these programs are widely used they will enhance children's performance in those skill areas. Incidental effects

of these programs will include certain levels of expectation of graphic, textual or sound reward for good performance (on computer programs) and possibly heightened awareness of computer capability. Of greater interest, however, are the effects of the emergent generation of computer courseware, of readily available multipurpose software, and of games.

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